Papahānaumokuākea Marine National Monument
Permit Application Cover Sheet

This Permit Application Cover Sheet is intended to provide summary information and status to the public on permit applications for activities proposed to be conducted in the Papahānaumokuākea Marine National Monument. While a permit application has been received, it has not been fully reviewed nor approved by the Monument Management Board to date. The Monument permit process also ensures that all environmental reviews are conducted prior to the issuance of a Monument permit.

Summary Information

Applicant Name: Donald C. Potts
Affiliation: University of California, Santa Cruz

Permit Category: Research
Proposed Activity Dates: 25 April 2008 - 31 December 2011
Proposed Method of Entry (Vessel/Plane): Plane - USFWS flights
Proposed Locations: Multiple shallow sites (<35 m) on and around Midway Atoll

Estimated number of individuals (including Applicant) to be covered under this permit:

Variable: 2-8 people at any one time

Estimated number of days in the Monument:

Up to 150 days per year; up to 600 days over 4 years.

Description of proposed activities: (complete these sentences):

a.) The proposed activity would…

… continue an integrated, multi-disciplinary program of biological, geological, oceanographic and hydrological studies that began in 2005 to establish baselines for understanding and detecting changes in the dynamics of processes that determine the structure, functioning and ecological services of the main habitats in Midway Atoll's reef ecosystem. The approach integrates: direct field observations; habitat monitoring by regular field observations, instruments, and satellite/airborne imaging; small experiments to quantify key rates of processes affecting reef growth and reef degradation; identification and monitoring of bio-indicators; collection of small biological, geological and water samples necessary for identification, classification, or physical and chemical analyses; and assessment of changes since human contact in the late 19th century.

b.) To accomplish this activity we would ….

… undertake 14 activities, 10 of which began in 2005-06 under USFWS permits and continued in 2007 under PMNM permits PMNM-2007-013 and PMNM-2007-013-A1. Four additional activities were foreshadowed previously, or build on observations in 2005-07:

1. SURVEYS: Continue existing sites and establish new sites in under-sampled habitats to assess reef health, and monitor recruitment, survival, and growth of major organisms.

2. CORAL ECOLOGY: Continue observations and experiments to quantify rates of coral reproduction, recruitment, survival, growth and mortality; and to evaluate direct impacts of bioerosion by herbivorous urchins and fish.

3. COMMUNITY DYNAMICS: Continue observations and experiments to quantify interactions among urchins, fishes, corals, coralline algae, fleshy algae, and physical processes; and to assess impacts of these interactions on reef growth and destruction.

4. HABITAT MONITORING: Continue deployment of underwater instruments to monitor physical/chemical water conditions, to record climatic and oceanographic variation within and among habitats, and to detect environmental changes.

5. VIDEO MONITORING: Continue deployment of an underwater video-recording system using infra-red illumination for 24 hr monitoring and quantification of bioerosion, behavior of mobile organisms, and ecological interactions among them.

6. REEF CONSTRUCTION Expand monitoring of reef framework accretion and erosion to better quantify rates of reef growth, reef erosion, and storm impacts in critical habitats.

7. SEDIMENTS: Continue mapping and sampling for sediment characteristics to determine sources and fates of eroded reef materials, and initiate experiments and monitoring of variation in hydraulic energy, turbulence, sediment transport, and sediment accumulation.

8. REEF HISTORY: Continue sampling rubble and taking cores for analyses of reef composition, identification of framework-building species, and reconstruction of reef history; and to quantify impacts on reef growth and erosion attributable to past anthropogenic impacts.

9. URCHIN MANAGEMENT: Expand experiments removing urchins to quantify impacts of urchins on entire coral-algal communities, to estimate magnitude of bioerosion attributable to excessive numbers of sea urchins, and to assess the feasibility of enhancing reef health by reducing urchin numbers.

10. CYANOBACTERIA: Continue studies to test hypotheses that cyanobacterial blooms are associated with dumpsites, metal debris or groundwater runoff onto the reef.

11. MICROBIAL BIO-INDICATORS: Expand surveys of cyanobacteria, diatoms, other algae, and possible disease organisms as early indicators of unfavorable conditions.

12. GROUNDWATER DISCHARGE: Expand sampling of groundwater and nearshore water to quantify nutrient and pollutant discharge from the islands, and assess impacts on reef.

13. BIVALVE BIO-INDICATORS: Initiate studies to determine abundances, habitats, recruitment, ecological significances, and reef-building potential of large bivalves (e.g. pearl, cliff, rock oysters); to assess their potential use as bio-indicators of

reef and lagoon health; and to evaluate possible measures to restore black-lipped pearl oyster populations.

14. REMOTE SENSING: Ground-truthing to obtain spectral signatures of cyanobacteria, other microorganisms, algae, and other potential biological, physical and geological indicators of change for future monitoring via satellite and/or airborne sensing.:

c.) This activity would help the Monument by …

1. Providing baseline information about current ecological and physical processes affecting growth and destruction of the Midway reef.
2. Assessing the current status and future sustainability of Midway Atoll as a viable ecosystem.
3. Distinguishing effects of past anthropogenic activity from those of "natural" processes.
4. Exploring potential responses as the system is exposed to projected atmospheric and oceanographic changes over the next 10-100 years.
5. Advising the USFWS and PMNM on management options and priorities, including potential interventions, restoration and other management measures.

Other information or background:

To maintain the continuity of our program, we are requesting permits to continue previously approved activities (PMNM-2007-013 and PMNM-2007-013-A1) over a period of four years (2008-2011) for which core funding is now available. We also plan to expand or initiate some activities rising from observations and data gathered during 2005-07.

Midway Atoll is the the only reef in the entire PMNM with a good harbor, air access, extensive infrastructure, accomodation, and other facilities. Hence its sustainability is essential for the longterm management of the PMNM. However, research to date indicates that reef-building corals on Midway's reef perimeter, in the lagoon, and on many parts of the reef flats are now declining in abundance; and that rates of physical and biological reef erosion are outstripping rates of reef accretion over much of the Midway reef. If this scenario continues, Midway will eventually cease to be a viable atoll, the islands will erode away, and the reef will become a submerged bank.

Recent IPCC (2007) projections of rapid changes in global climate, sea level, oceanography, and ocean acidification all suggest that rates of biological and physical erosion, and overall reef degradation are likely to increase, while rates of calcification, reef growth, and sediment accretion will probably decline over coming decades. If valid, cumulative effects of these multiple rate changes are likely to accelerate degradation of Midway Atoll and hasten its demise as a sustainable ecosystem.

While adverse affects of climate and ocean change will affect all reefs in the PMNM, Midway is likely to experience them earlier and more intensely due to:

1. Its ecologically and latitudinally marginal location (second northernmost Pacific atoll); 2. Its setting in the potentially unstable, steep environmental gradients of the transition between the warm equatorial zones and the cool North Pacific Gyre; and 3. Its history of intense anthropogenic disturbance during 130 years of successive exploitation, cable station, PanAmerican facility, and US Navy base. Past human activities have impacted Midway's reef more severely than any other PMNM reef, and the magnitude, extent and duration of such activities as dredging, construction, landfilling, and other disturbances may be responsible for much of the present poor condition of Midway's reef, and continuing effects may threaten its sustainability.

In 2005, the U.S. Fish and Wildlife Service, the Midway Atoll National Wildlife Refuge, the University of California at Santa Cruz, and the Mitsubishi Corporation (Tokyo) concluded several bilateral agreements that initiated our present program of cooperative research and field trials, including direct tests of potential management interventions. The entire program was designed to advance understanding of the reef as a whole, and to explore ways to enhance long-term sustainability of the Midway Atoll National Wildlife Refuge.